

# Stream Crossings

## Stream Crossings

Stream crossing structures are installed across intermittent or perennial streams to provide access for logging equipment. When properly located and constructed, stream crossing structures can prevent damage to the bed and banks of streams and can control the movement of sediment into the water.

Stream crossing structures that are poorly located or constructed can result in disturbance of the banks and bottoms of streams, increasing the chance for erosion and sedimentation to occur.

A forestry professional or Department of Forestry forest engineer can assist in planning the stream crossing structure best suited to the site.

## Locating Stream Crossings

- Use stream crossings only when absolutely necessary.
- Keep the number of stream crossings to a minimum.
- Cross streams by the most direct route and at a right angle to the flow of the stream, if possible

# Stream Crossings

- Whenever possible, find stream crossing sites that have low, stable banks, a firm stream bottom, minimal surface runoff, and gentle slopes along the approaches.
- Stabilize the soil around all culverts and bridges immediately after installation.

A permit is required from the Virginia Marine Resources Commission for all stream crossing structures that cross a stream that has a drainage area of greater than five square miles .



## Stream Crossing Design

Operating equipment in or near perennial or intermittent stream channels may add sediment directly to streams.

As roads approach a stream crossing, proper road drainage is critical to avoiding sedimentation in streams. Three common stream crossing structures are bridges, culverts and fords.

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## Bridges

Bridges are the preferred method of crossing streams because they require little or no in-stream work to install. They typically require less time to install and can be used over many times, thus making them more cost-effective than culverts. Because they cause little disturbance to the stream banks or channel, they also have less effect on fisheries than any other crossing method.

*Any bridge installed for use by the general public for public transport should be designed by a licensed civil engineer.*



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## Bridge Installation

- Temporary bridges should be installed at right angles to the stream.
- Bridges should be of sufficient length to maintain at least 5 feet of bridge/ground contact on each side of the stream (this will vary by bridge design).
- Mud sills consisting of rough sawn hardwood beams 16 inches wide, three inches thick and 16 feet long can be used to provide additional load bearing capacity in soft soils.
- Approaches should be stabilized with rock, corduroy, brush or other non-erodible surface for a distance of 50 feet on either side of the bridge.
- Prompt stabilization after removal of the bridge will be most critical to the protection of stream water quality.



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## Pole Bridges

Pole bridges may be used when crossing a stream channel where no water is present. Pole bridges are constructed by laying wooden logs of no less than 10 inches in diameter in a stream channel, creating a solid foundation on which to skid. This structure may incorporate the use of heavy gauge steel pipe with the logs to allow for short periods of flow should it rain.

*Pole bridges should not be used on channels greater in width or depth than the diameter of a skidder tire.*

Pole bridges can be used in dry, intermittent stream channels for a short period of time.

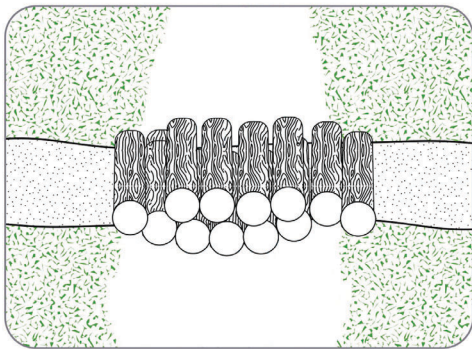
## Pole Bridge Installation

- Pole bridges should be packed sufficiently so as not to allow the skidder to dip below the streambank edge and cause erosion of the bank.
- A heavy gauge steel pipe incorporated in the structure will help in the event of an unforeseen rainfall event while the structure is in place.

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- Pole bridges should not have any dirt associated with the logs.
- Pole bridges must be removed following use of the crossing.
- Stabilize the approaches with the appropriate water diversion structures and vegetation following removal of the structure.

### POLE BRIDGE



# Stream Crossings

## Culverts

Culverts may be either temporary or permanent installations. Temporary culverts are those that are installed and used for fewer than 30 consecutive months.

Permanent culverts are those remaining after the logging operation at the request of the timber buyer or landowner. (Proper permitting may be required for this situation. Check with the DOF forest engineer for the region prior to installation of a permanent culvert.)

Most culvert installations for harvesting purposes are considered to be temporary and must be removed. A reduced-sized culvert is permitted for temporary installations.

## Temporary Culvert Chart

The table on the next page lists culvert diameters for temporary culvert sizes. *This chart is intended to be used as a guide. No guarantees are given nor are any implied by its use.*

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<b>Table 5 Temporary Culvert Sizing (2-Year Event)</b>			
<b>Culvert Size (inches)</b>	<b>Coastal</b>	<b>Piedmont</b>	<b>Mountains</b>
<b>15</b>	<b>Up to 65</b>	<b>Up to 35</b>	<b>Up to 15</b>
<b>18</b>	<b>65-90</b>	<b>35-65</b>	<b>15-25</b>
<b>24</b>	<b>90-200</b>	<b>65-110</b>	<b>25-40</b>
<b>30</b>	<b>200-400</b>	<b>110-210</b>	<b>40-60</b>
<b>36</b>	<b>400-700</b>	<b>210-420</b>	<b>60-135</b>
<b>42</b>	<b>-</b>	<b>-</b>	<b>135-230</b>

- Based on the NRCS TR-55 Method modified for a 2-year frequency storm event.
- Assumes B soils; a CN-55; and sheet and shallow concentrated flows only for averages of 4 watersheds for each physiographic region of the state.
- Culvert crossing solutions for watersheds greater than 600 acres should be designed based on the specific situation.



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**Table 6**  
**Permanent Culvert Sizing Chart (10-Year Event)**

Culvert Size (inches)	Watershed (acres)		
	Coastal	Piedmont	Mountains
15	Up to 8	Up to 7	Up to 4
18	8-12	7-10	4-7
24	12-25	10-20	7-12
30	25-35	20-30	12-15
36	35-70	30-50	15-25
42	70-100	50-75	25-35
48	100-150	75-110	35-55
54	150-240	110-170	55-75
60	240-360	170-240	75-100
66	360-550	240-350	100-135
72	-	-	135-200

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If it is preferable to place multiple smaller culverts instead of one large one, the following table shows the required diameters of multiple pipes to replace one larger one.

Table 7 Culvert Alternatives (Diameter in Inches)		
Required Culvert Diameter	2 Culvert Alternative	3 Culvert Alternative
15	-	-
18	15, 15	-
24	15, 18	15, 15, 15
30	18, 24	18, 18, 18
36	24, 30	18, 24, 24
42	30, 30	24, 24, 30
48	36, 36	30, 30, 30
54	36, 42	30, 36, 36
60	42, 48	36, 36, 42
66	42, 54	42, 42, 42
72	48, 60	48, 48, 48
84	60, 66	48, 54, 54

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## Culvert Installation

- The pipe length will extend 1 foot beyond the edge of the fill material on each side of the culvert.
- The culvert should be placed on the same grade as the natural stream bottom.
- Culverts should be installed with 10% of its diameter below the streambed. This will minimize undercutting at the inlet or outlet. If the outlet is more than 6 inches above the natural stream channel, an energy absorbing structure should be placed at the outlet.
- Culverts require periodic maintenance and inspection to avoid blockage.
- Culvert pipes less than 15 inches in diameter are not recommended for stream crossings.



# Stream Crossings

## Fords



Natural rock fords are an acceptable crossing method in portions of the Piedmont and Mountains areas. They may also prove useful with improvements to portions of the Coastal Plain. In certain situations, they may be the most acceptable of the stream crossing types because of the reduced amount of continued stream disturbance.

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Any changes made to stream bottoms—including the addition of foreign material or unnatural material into a stream that has a drainage area in excess of five square miles—requires a permit from the Virginia Marine Resources Commission.

## Construction of a Ford

- Locate fords where stream banks are low.
- The stream should have a firm rock or gravel base; otherwise, install stabilizing material such as reinforced concrete planks, rubber or wooden mats or Geoweb® for improvement of streambed stabilization.